Compact, capable smart cameras with an intuitive, versatile and extendable integrated development environment for machine vision applications
Matrox Iris GTR with Matrox Design Assistant

Compact, capable smart cameras
Matrox Iris GTR with Matrox Design Assistant is a line of compact, capable smart cameras with an intuitive, versatile and extendable integrated development environment (IDE). Manufacturing engineers and technicians can easily and quickly configure and deploy machine vision applications on a highly integrated platform without the need for conventional programming. Video capture, analysis, location, measurement, reading, verification, communication and I/O operations, as well as a web-based operator interface are all set up within the single IDE.

Industries served
Matrox Design Assistant is used to put together solutions for the agricultural, aerospace, automotive, beverage, consumer, construction material, cosmetic, electronic, energy, food, flat panel display, freight, machining, medical device, paper, packaging, pharmaceutical, printing, resource, robotics, security, semiconductor, shipping, textile, and transportation industries.

Matrox Iris GTR Benefits

- **Installs comfortably in confined and dirty industrial environments** by way of a compact IP67-rated design
- **Runs typical vision jobs efficiently** using an Intel® dual-core embedded processor
- **Captures images at high speed** through a choice of CMOS sensors
- **Simplifies vision setup and upkeep** via integrated lens focusing and illumination intensity control
- **Interacts with vision and automation devices** by way of real-time digital I/Os
- **Synchronizes to the manufacturing line** through the support for incremental rotary encoders
- **Communicates with automation controllers and enterprise networks** via a Gigabit Ethernet interface
- **Takes on HMI function** by way of VGA and USB connectivity
- **Configured with ease for vision inspection and guidance** using Matrox Design Assistant flowchart-based vision software
Smart camera development platform

Develop and deploy your application

1. Develop an application, including the operator interface, using Matrox Design Assistant running on a PC.

2. Use Matrox Design Assistant to deploy the application from the PC to the Matrox Iris GTR smart camera.

3. Run the application on a Matrox Iris GTR independent of the PC. View the application’s operator interface from a PC.
Matrox Design Assistant

Matrox Design Assistant

Matrox Design Assistant is an integrated development environment (IDE) where vision applications are created by constructing an intuitive flowchart instead of writing traditional program code. In addition to building a flowchart, the IDE enables users to directly design a graphical operator interface for the application. Since Design Assistant is hardware independent, you can choose any computer with GigE Vision® or USB3 Vision™ cameras and get the processing power you need. This field proven software is also a perfect match for the Matrox 4Sight GPm vision controller or the Matrox Iris GTR smart camera. Design Assistant gives you the freedom to choose the ideal platform for your next vision project.

Application design

Flowchart and operator interface design are done within the Matrox Design Assistant IDE hosted on a computer running 64-bit Windows®. A flowchart is put together using a step-by-step approach, where each step is taken from an existing toolbox and is configured interactively. The toolbox includes steps for image analysis and processing, communication, flow-control, and I/O. Outputs from one step, which can be images and/or alphanumeric results, are easily linked to the appropriate inputs of any other step. Decision making is performed using a conditional step, where the logical expression is described interactively. Results from image analysis and processing steps are immediately displayed to permit the quick tuning of parameters. A contextual guide provides assistance for every step in the flowchart. Flowchart legibility is maintained by grouping steps into sub-flowcharts.

In addition to flowchart design, Matrox Design Assistant enables the creation of a custom, web-based operator interface to the application through an integrated HTML visual editor. Users alter an existing template using a choice of annotations (graphics and text), inputs (edit boxes, control buttons and image markers) and outputs (original or derived results, and status indicators). A filmstrip view is also available to keep track of, and navigate to, previously analyzed images. The operator interface can be further customized using a third-party HTML editor.

Matrox Design Assistant can be used with a Matrox Iris GTR smart camera or in emulation mode. The latter allows for the design and testing of a flowchart and the creation of an operator interface without being connected to the smart camera. Matrox Design Assistant’s emulation mode is used to enable parallel project work, resulting in greater development efficiency.

Why a flowchart?

The flowchart is a universally accessible, recognized and understood method of describing the sequence of operations in a process. Manufacturing engineers and technicians in particular have all been exposed to the intuitive, logical and visual nature of the flowchart.
Application deployment

Once development is complete, the project, with flowchart and operator and operator interface, are downloaded to, and stored locally on, the Matrox Iris GTR smart camera. The flowchart is then executed on the smart camera independent of any PC.

Matrox Design Assistant maintenance program

Matrox Design Assistant users who register their software are automatically enrolled in the maintenance program for one year. This maintenance program entitles registered users to technical support and free software upgrades from Matrox Imaging. Just before the expiration of the maintenance program, registered users will have the opportunity to extend the program for another year. For more information, refer to the Matrox Imaging Software Maintenance Programs brochure.

Samples, tutorials and training

Matrox Design Assistant includes numerous sample projects and video tutorials to help new developers quickly become productive. Matrox Imaging also offers an instructor-led training course held at Matrox headquarters and select locations worldwide. Refer to the support section at www.matrox.com/imaging for more information.
Customizable developer interface
The Matrox Design Assistant user interface can be tailored by each developer. The workspace can be rearranged, even across multiple monitors, to suit individual preferences and further enhance productivity.
Operator view

Operator interface viewable anywhere

The web-based operator interface, or Operator View, can be accessed remotely through a HTML5-capable web browser running on a desktop, HMI or touch-panel PC. The Operator View can also be accessed through the web browser running on the Matrox Iris GTR by way of a simple touch screen connected to the smart camera’s video output and USB interface, eliminating the need for a PC.

A stand-alone HMI application can be created using Microsoft® Visual Studio® to run on a remote PC as an alternative to the web-based operator interface.

Security Features

Access to specific Operator Views can be made to require user authentication (i.e., username and password) so only authorized personnel can modify key parameters of a running project.

A project can be locked to a specific Matrox Iris GTR when deployed, preventing it from running on an unauthorized smart camera. A project can also be encrypted during deployment to a smart camera, insuring that the project cannot be read or changed by unauthorized users. Projects locked to a camera are automatically encrypted.

All accesses to a smart camera can be restricted by disabling or adding access rights to the various servers running on the camera (HTTP, FTP, TELNET, file server). The number of connections to any one of these servers can also be controlled.
Vision tools

Image analysis and processing

Central to Matrox Design Assistant are flowchart steps for calibrating, enhancing and transforming images, locating objects, extracting and measuring features, reading character strings, and decoding and verifying identification marks. These steps are designed to provide optimum performance and reliability.

Pattern recognition

Matrox Design Assistant includes two steps for performing pattern recognition: Pattern Matching and Model Finder. These steps are primarily used to locate complex objects for guiding a gantry, stage or robot, or for directing subsequent measurement steps.

The Pattern Matching step finds a pattern by looking for a similar spatial distribution of intensity. The step employs a smart search strategy to quickly locate multiple patterns, including multiple occurrences, which are translated and slightly rotated. The step performs well when scene lighting changes uniformly, which is useful for dealing with attenuating illumination. A pattern can be trained manually or determined automatically for alignment. Search parameters can be manually adjusted and patterns can be manually edited to tailor performance.

The Model Finder step employs an advanced technique to locate an object using geometric features (e.g., contours). The step finds multiple models, including multiple occurrences that are translated, rotated, and scaled. Model Finder locates an object that is partially missing and continues to perform when a scene is subject to uneven changes in illumination; relaxing lighting requirements. A model is manually trained from an image and search parameters can be manually adjusted and models can be manually edited to tailor performance.
Vision tools (cont.)

Feature extraction and analysis

The Blob Analysis step is used to identify, count, locate and measure basic features and objects (i.e., blobs) to determine presence and position, and enable further inspection. The step works by segmenting images, where blobs are separated from the background and one another, before quickly identifying the blobs. Over 50 characteristics can be measured and these measurements can be used to eliminate or keep certain blobs.
Vision tools (cont.)

1D and 2D measurements

Matrox Design Assistant includes three steps for measuring: Measurement, Bead Inspection and Metrology. These tools are predominantly used to assess manufacturing quality.

The Measurement step uses the projection of image intensity to very quickly locate and measure straight edges or stripes within a carefully defined rectangular region. The tool can make several 1D measurements on edges and stripes, as well as between edges or stripes.

The Bead Inspection step is for inspecting material that is applied as a continuous sinuous bead, such as adhesives and sealants, or its retaining channel. The step identifies discrepancies in length, placement and width, as well as discontinuities. The Bead Inspection step works by accepting a user-defined coarse path (as a list of points) on a reference bead and then automatically and optimally placing search boxes to form a template. The size and spacing of these search boxes can be modified to change the sampling resolution. The allowable bead width, offset, gap and overall acceptance measure can be adjusted to meet specific inspection criteria.

The Metrology step is intended for 2D geometric dimensioning and tolerancing applications. The step extracts edges within defined regions to best fit geometric features. It also supports the construction of geometric features derived from measured ones or defined mathematically. Geometric features include arcs, circles, points, and segments. The step validates tolerances based on the dimensions, positions, and shapes of geometric features. The step’s effectiveness is maintained when subject to uneven changes in scene illumination, which relaxes lighting requirements. The expected measured and constructed geometric features, along with the tolerances, are kept together in a template, which is easily repositioned using the results of other locating steps.
Vision tools (cont.)

Color analysis

Matrox Design Assistant includes a set of tools to identify parts, products and items using color, assess quality from color, and isolate features using color.

The Color Matcher step determines the best matching color from a collection of samples for each region of interest within an image. A color sample can be specified either interactively from an image - with the ability to mask out undesired colors - or using numerical values. A color sample can be a single color or a distribution of colors (i.e., histogram). The Color Matching method and the interpretation of color differences can be manually adjusted to suit particular application requirements. The Color Matcher step can also match each image pixel to color samples to segment the image into appropriate elements for further analysis using other steps such as Blob Analysis.

The Image Processing step includes operations to calculate the color distance and perform color projection. The distance operation reveals the extent of color differences within and between images, while the projection operation enhances color to grayscale image conversion for analysis using other grayscale processing steps.

Character recognition

Matrox Design Assistant provides two steps for character recognition: SureDotOCR™ and String Reader. These steps combine to read text that is engraved, etched, marked, printed, punched or stamped on surfaces.

The SureDotOCR step is uniquely designed for the specific challenge of reading dot-matrix text produced by inkjet printers. Its use is straightforward, just needing to specify the dot size, the number of characters in a text string and the dimension, but not the location, of the text region. The step reads strings located at any angle, with varying contrast and on an uneven background. It interprets distorted characters and handles some variability to character scale. The step recognizes punctuation marks and blank spaces. It includes pre-defined fonts that can be edited. The step automatically reads multiple lines of text where each line can be in a different font. It supports user-defined constraints, overall and at specific character positions, to further enhance recognition rates. The SureDotOCR step provides greater robustness and flexibility than case-specific techniques that convert dot-matrix characters into solid ones for reading with traditional character recognition tools.

The String Reader step is based on a sophisticated technique that uses geometric features to quickly locate and read text made up of solid characters in images where these characters are well separated from the background and from one another. It handles text strings with a known or unknown number of evenly or proportionally spaced characters. The step accommodates changes in character angle with respect to the string, aspect ratio, scale, and skew, as well as contrast reversal. It accepts strings located across multiple lines and at a slight angle. The step reads from multiple pre-defined or user-defined Latin-based fonts. It supports user-defined constraints, overall and at specific character positions, to further increase recognition rates.
Vision tools (cont.)

1D and 2D code reading and verification

Code Reader is a step for locating and reading 1D, 2D and composite identification marks. The step handles rotated, scaled, and degraded codes in tough lighting conditions. The step can provide the orientation, position, and size of a code.

In addition, the Code Verify step verifies the quality of a code based on the ANSI/AIM and ISO/IEC grading standards.
Vision tools (cont.)

Calibration
Calibration is a routine requirement for machine vision. Matrox Design Assistant includes a 2D Calibration step to convert results (i.e., positions and measurements) from pixel to real-world units and vice-versa. The tool can compensate results and even an image itself for camera lens and perspective distortions. Calibration is achieved using an image of a grid or just a list of known points and is performed through a utility project accessed from the Matrox Design Assistant configuration portal.

Basic image processing
Matrox Design Assistant includes the Image Processing step for enhancing and transforming images in preparation for subsequent analysis. Supported operations include arithmetic, color space conversions, color distance and projection (refer to Color analysis section for details), filtering, geometric transformations, logic, LUT mapping, morphology and thresholding.

Matrox Design Assistant also includes Edge Locator and Intensity Checker. Edge Locator finds objects by locating straight edges and Intensity Checker is used to analyze an object using image intensity.
Utilities

Matrox Profiler

Matrox Design Assistant includes Matrox Profiler, a separate utility to post-analyze the execution of a vision project for performance bottlenecks and timing issues. It presents the flowchart steps executed over time on a navigable timeline. Matrox Profiler permits searching for and selecting specific steps and their execution times for analysis. It computes statistics on execution times and presents these on a per step basis.
Connect to devices and networks

Matrox Iris GTR features a 10/100/1000 Mbit Ethernet interface for connecting over factory-floor and enterprise networks. Communication over these networks is configured through Matrox Design Assistant and can employ the TCP/IP as well as the EtherNet/IP™, Modbus over TCP/IP and PROFINET protocols, enabling interaction with programmable logic/automation controllers.

Its QuickComm facility provides ready-to-go communication with these controllers. Direct communication can be established with select robot controllers for 2D vision-guided robotic applications. The Matrox Iris GTR can also be configured to directly interact with automation devices through eight industrial digital I/Os (four inputs and four outputs).
# Compare Models

## Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>GTR300</th>
<th>GTR300C</th>
<th>GTR1300</th>
<th>GTR1300C</th>
<th>GTR2000</th>
<th>GTR2000C</th>
<th>GTR5000</th>
<th>GTR5000C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor</td>
<td>PYTHON 300</td>
<td>PYTHON 1300</td>
<td>PYTHON 2000</td>
<td>PYTHON 3000</td>
<td>CMOS</td>
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<td>Type</td>
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<tr>
<td>Geometry</td>
<td>¼”</td>
<td>¼”</td>
<td>½”</td>
<td>½”</td>
<td>2/3”</td>
<td>2/3”</td>
<td>1”</td>
<td>1”</td>
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<tr>
<td>Format</td>
<td>Monochrome</td>
<td>Color</td>
<td>Monochrome</td>
<td>Color</td>
<td>Monochrome</td>
<td>Color</td>
<td>Monochrome</td>
<td>Color</td>
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<tr>
<td>Resolution (H x V)</td>
<td>640 x 480</td>
<td>1280 x 1024</td>
<td>1920 x 1200</td>
<td>2592 x 2048</td>
<td>Monochrome</td>
<td>Color</td>
<td>Monochrome</td>
<td>Color</td>
</tr>
<tr>
<td>Frame rate (effective)</td>
<td>Up to 293 fps</td>
<td>Up to 147 fps</td>
<td>Up to 85 fps</td>
<td>Up to 35 fps</td>
<td>Up to 45 fps</td>
<td>Up to 20 fps</td>
<td>Up to 21 fps</td>
<td>Up to 8.5 fps</td>
</tr>
<tr>
<td>Pixel size (H x V)</td>
<td>4.8 µm x 4.8 µm</td>
<td>4.8 µm x 4.8 µm</td>
<td>4.8 µm x 4.8 µm</td>
<td>4.8 µm x 4.8 µm</td>
<td>4.8 µm x 4.8 µm</td>
<td>4.8 µm x 4.8 µm</td>
<td>4.8 µm x 4.8 µm</td>
<td>4.8 µm x 4.8 µm</td>
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<tr>
<td>Shutter speeds</td>
<td>50 µsec to 4 sec</td>
<td>50 µsec to 4 sec</td>
<td>50 µsec to 4 sec</td>
<td>50 µsec to 4 sec</td>
<td>50 µsec to 4 sec</td>
<td>50 µsec to 4 sec</td>
<td>50 µsec to 4 sec</td>
<td>50 µsec to 4 sec</td>
</tr>
<tr>
<td>External trigger latency</td>
<td>7.1 µs</td>
<td>7.2 µs</td>
<td>8.0 µs</td>
<td>8.0 µs</td>
<td>7.1 µs</td>
<td>7.2 µs</td>
<td>8.0 µs</td>
<td>8.0 µs</td>
</tr>
<tr>
<td>Ext. trigger to strobe output delay</td>
<td>9.1 µs</td>
<td>9.2 µs</td>
<td>10 µs</td>
<td>10 µs</td>
<td>9.1 µs</td>
<td>9.2 µs</td>
<td>10 µs</td>
<td>10 µs</td>
</tr>
</tbody>
</table>

### Processor, memory and storage

- Processor: Intel® Celeron® N2807 (dual core 1.58 GHz)
- Memory: 2GB DDR3L SDRAM
- Storage: 32GB eMMC

### Interfaces

- Network: Gigabit Ethernet
- HMI: VGA and USB 2.0 (for keyboard and mouse)
- Digital I/Os: 3 opto-coupled inputs (with incremental rotary encoder support), 1 dedicated opto-coupled trigger and 3 outputs
- Other: dedicated 0-10V LED lighting intensity control for AI ICS 3 and dedicated interface for Varioptic Caspian auto-focus lens

### Mechanical, electrical and environmental information

- Dimensions: Refer to Dimensions
- Lens type: C-mount
- Connectors: M12-8 pins female for Ethernet, M12-12 pins female for power, digital IOs and LED lighting intensity control, M12-12 pins male for VGA and USB
- Weight: 460g
- Power consumption: 450 mA @ 24VDC or 10.8W (typical)
- Operating temperature: 0°C to 50°C (32°F to 122°F)
- Ventilation requirements: natural convection
- Certifications: FCC Part 15 Class A, CE mark: EN55011 Class A, EN61326-1 Industrial environment, IEC6-003/NMB-003 Class A, RCM Class A, IP67 enclosure (IEC 60529 - dust tight and protected against temporary immersion), Shock and Vibration: EN60721-3-3/A2, Category 3M8. Shock:IEC 60068-2-27, 50G, 3ms, type II, half sine; Random Vibration: IEC60068-2-64, 10 Hz to 500 Hz, 50Grms, 100 min. Sine vibration: IEC60068-2-6, 10 Hz to 500 Hz, 5g.

### Software environment (pre-installed)

- PC development tools: Matrox Design Assistant IDE
- PC requirements: 64-bit Windows® 7 with SP1 / 8.1 / 10 (Version 1511 and up) and HTML5-capable browser.
Dimensions: (inches) millimeters
## Order

### Hardware

<table>
<thead>
<tr>
<th>Part number &amp; Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTR300</td>
<td>Matrox Iris GTR smart camera with monochrome 640x480 sensor, dual-core Celeron® CPU, 2GB of memory, 32GB eMMC storage. Includes Design Assistant.</td>
</tr>
<tr>
<td>GTR300C</td>
<td>Matrox Iris GTR smart camera with color 640x480 sensor, dual-core Celeron® CPU, 2GB of memory, 32GB eMMC storage. Includes Design Assistant.</td>
</tr>
<tr>
<td>GTR1300</td>
<td>Matrox Iris GTR smart camera with monochrome 1280 x 1024 sensor, dual-core Celeron® CPU, 2GB of memory, 32GB eMMC storage. Includes Design Assistant.</td>
</tr>
<tr>
<td>GTR1300C</td>
<td>Matrox Iris GTR smart camera with color 1280 x 1024 sensor, dual-core Celeron® CPU, 2GB of memory, 32GB eMMC storage. Includes Design Assistant.</td>
</tr>
<tr>
<td>GTR2000</td>
<td>Matrox Iris GTR smart camera with monochrome 1920 x 1200 sensor, dual-core Celeron® CPU, 2GB of memory, 32GB eMMC storage. Includes Design Assistant.</td>
</tr>
<tr>
<td>GTR2000C</td>
<td>Matrox Iris GTR smart camera with color 1920 x 1200 sensor, dual-core Celeron® CPU, 2GB of memory, 32GB eMMC storage. Includes Design Assistant.</td>
</tr>
<tr>
<td>GTR5000</td>
<td>Matrox Iris GTR smart camera with monochrome 2592 x 2048 sensor, dual-core Celeron® CPU, 2GB of memory, 32GB eMMC storage. Includes Design Assistant.</td>
</tr>
<tr>
<td>GTR5000C</td>
<td>Matrox Iris GTR smart camera with color 2592 x 2048 sensor, dual-core Celeron® CPU, 2GB of memory, 32GB eMMC storage. Includes Design Assistant.</td>
</tr>
<tr>
<td>GTR-STARTER-KIT</td>
<td>Matrox Iris GTR starter kit for all models except GTR5000[C]. Includes power supply, 12mm C-mount lens, Ethernet cable, power cable, VGA/USB cable and breakout board for digital I/Os. For development purposes only. Not to be used for deployment.</td>
</tr>
<tr>
<td>GTR5000-STR-KIT</td>
<td>Matrox Iris GTR starter kit for GTR5000[C]. Includes power supply, 12mm C-mount lens for 5 MPixel sensor, Ethernet cable, power cable, VGA/USB cable and breakout board for digital I/Os. For development purposes only. Not to be used for deployment.</td>
</tr>
<tr>
<td>GTR-CBL-PWR/3</td>
<td>9.8’ or 3m cable for Matrox Iris GTR to connect power, discrete I/Os and LED lighting intensity control. M12 to open end.</td>
</tr>
<tr>
<td>GTR-CBL-ETH/S</td>
<td>16.4’ or 5m Ethernet cable for Matrox Iris GTR. M12 to RJ45 connector.</td>
</tr>
<tr>
<td>GTR-CBL-VGAUSB</td>
<td>3.2’ or 1m cable for Iris GTR to connect VGA and USB. M12 to HD-15 and USB connectors.</td>
</tr>
</tbody>
</table>

### Software

#### Matrox Design Assistant

Matrox Iris GTR with Matrox Design Assistant comes pre-loaded with the run-time environment for the latter and includes a DVD to install the design-time environment for the latter. Also included is a Matrox Design Assistant Maintenance registration number. Matrox Iris GTR with Matrox Design Assistant is pre-licensed for the Blob Analysis, Bead Inspection, Calibration, Code Reader, Color Analysis (GTR…C* models only), Edge Locator (not Edge Finder), Image Processing, Intensity Checker, Metrology, Pattern Matching, I/O and communication features. Additional features like Model Finder and/or String Reader/SureDotOCR require the installation of an additional license (see MIL datasheet – MIL 10 Run-Time Licenses section).

#### Matrox Design Assistant Maintenance Program

<table>
<thead>
<tr>
<th>Part number Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Included in the original purchase price of the Matrox Iris GTR with Matrox Design Assistant, it entitles registered users to one year of technical support and access to updates.</td>
</tr>
<tr>
<td>DAMAINT One-year extension to Matrox Design Assistant maintenance program per developer.</td>
</tr>
</tbody>
</table>

Note: 75% discount for DAMAINTENANCE if purchased with MIL Maintenance (i.e., MILMAINTENANCE) for the same user. 50% educational discount for DA4MAINT with proof of institutional affiliation. Discounts cannot be combined.

#### Matrox Design Assistant Training

<table>
<thead>
<tr>
<th>Part number Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DA TRAIN Ask for availability. &quot;Matrox Design Assistant environment&quot; training. 2+ day instructor-led training. Visit <a href="http://www.matroximaging.com/training">www.matroximaging.com/training</a> for more information.</td>
</tr>
</tbody>
</table>

### Endnotes:

1. This product may be protected by one or more patents. See www.matrox.com/patents.
2. 64-bit Windows® 7 with SP1 / 8.1 / 10 (Version 1511 and up).
3. Certification pending.
4. Any HTML5-capable web browser.
5. Requires a supplemental license.
About Matrox Imaging

Founded in 1976, Matrox is a privately held company based in Montreal, Canada. Graphics, Video and Imaging divisions provide leading component-level solutions for commercial graphics, professional video editing and industrial imaging respectively. Each division leverages the others’ expertise and industry relations to provide innovative timely products.

Matrox Imaging is an established and trusted supplier to top OEMs and integrators involved in the manufacturing, medical diagnostic and security industries. The components delivered consist of cameras, interface boards and processing platforms, all designed to provide optimum price-performance within a common software environment.